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Title: ALPHA SPECTRUM ANALYSIS

Author(s): JAMES T. VOSS
HSR-1, LOS ALAMOS NATIONAL LABORATORY

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ALPHA SPECTRUM ANALYSIS ALGORITHMS AND ALARM STRATEGIES FOR CAMS (CONTINUOUS AIR MONITORS)

What are some of the variables we need to consider?

Variable	Number of Variations
Air sampling rate	30, 37, 45, 60 LPM (and in both SLPM and ambient LPM units)
Sample collection media	SSWP, SMWP, Fluoropore 3 and 5 micron, RW19, GFA
Sample collection diameter	22, 25, 37, 42, 44 mm
Detector type	SB, DJ, Ion Implant, Depleted depths from 50 to 1,000 microns; protective coatings with thicknesses from 25 to 50 microns (metal and metal + organic coatings with various metals and organic coating materials)
Detector diameter	25, 37, 50 mm
Preamplifier	specific by manufacturer
MCA	specific by manufacturer
Detector to sample spacing	4, 7, 12 mm
Alpha particle collimator	Most CAMs do not use a collimator; there are 2 types of collimators that have used
Analysis algorithm	specific by manufacturer (typically a specific CAM type does not utilize multiple analysis algorithms)
Alarm strategy	specific by manufacturer (typically a specific CAM type does not utilize multiple alarm strategies)

This table covers ONLY SOME of the variables we need to consider.

Just with these possible variations there are several million ways an alpha CAM could collect and quantify the airborne radioactivity!

What are some of the analysis algorithms?

Algorithms for alpha-only detection.

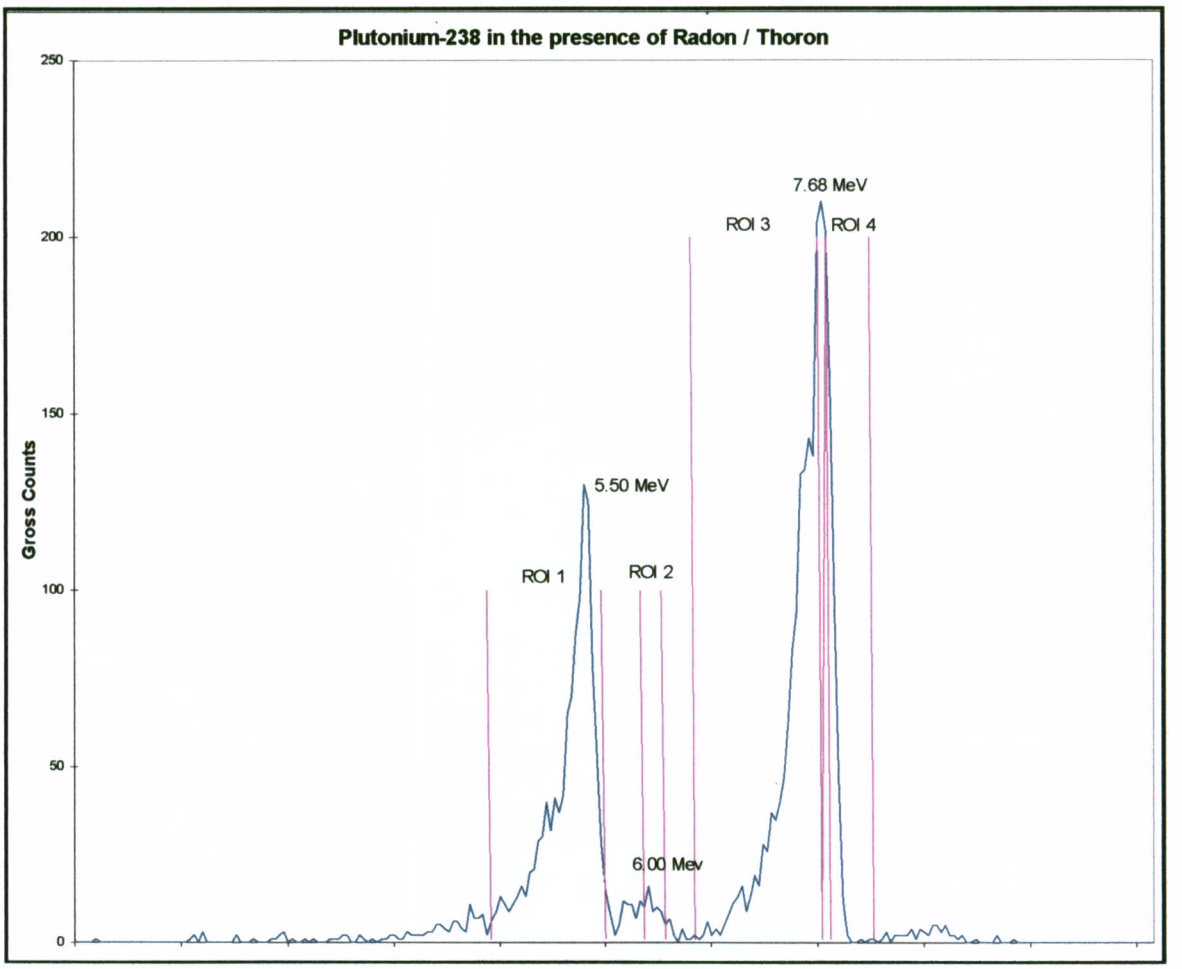
Algorithm	Description
Gross counting	Count all events in the detector above a set threshold; there is NO subtraction for radon and thoron progenty
Single window counting	Count all events in the detector between the lower and upper discriminators
Two window counting	Count the events in the detector in a lower and upper alpha energy window and subtract a percentage of the upper window counts from the lower window counts. Typically the lower alpha energy window would be set for the alpha particle energies the user wishes to quantify and the upper window would be set for the interfering radon and thoron progeny. The width of both the lower and upper windows are typically adjustable.
Multiple regions of interest	3, 4, or 5 ROIs, individual peaks, splitting peaks into low and high energy tails, subtraction K factors
Peak shape fitting	Subtraction of the low energy tail of the interfering radon And thoron progeny Self-Adaptable peak shape fitting

Algorithms for detectors with alpha and beta detection.

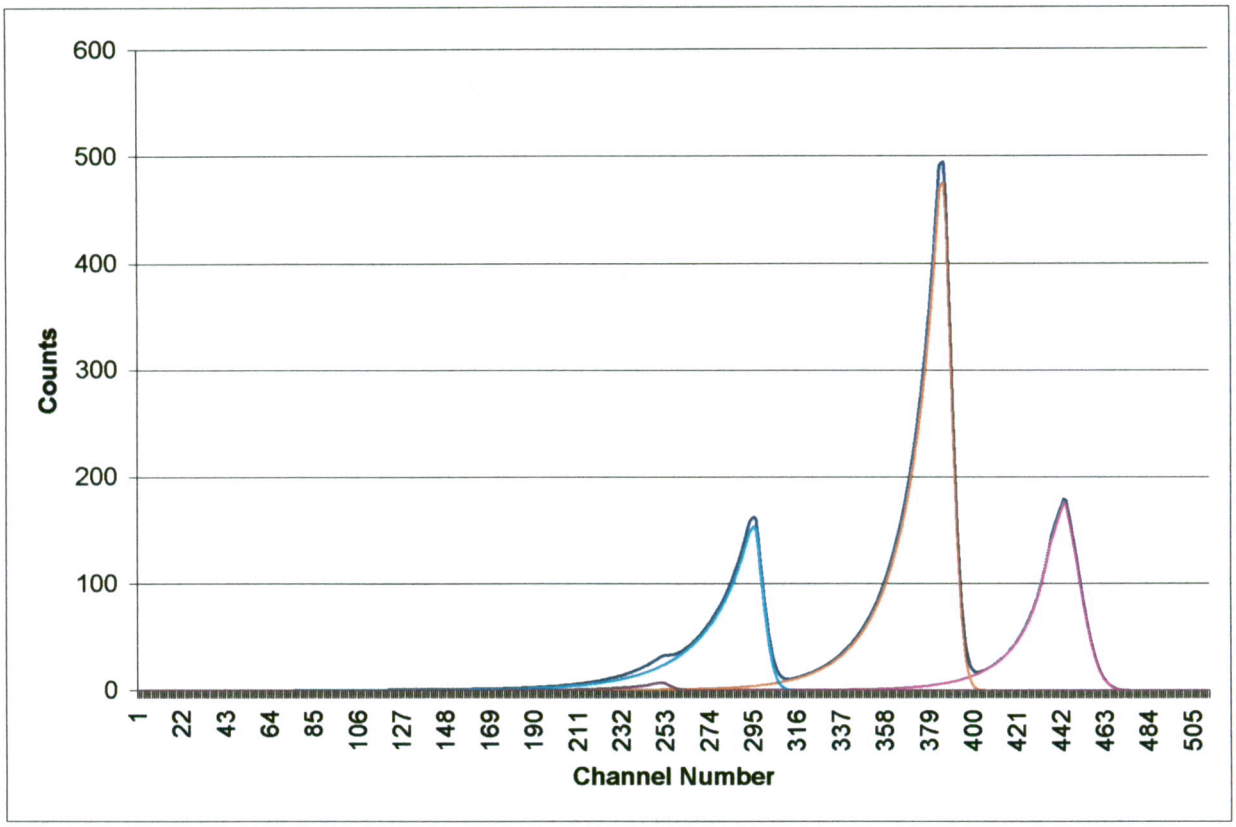
Algorithm	Description
Two window counting	Count the events in the detector in a lower beta energy Window and an upper alpha energy window and subtract a percentage of the lower window counts from the lower window counts. This technique is used in a few types of combination alpha/beta detectors, both fixed and adjustable alpha to beta ratios are used.
Multiple regions of interest	3, 4, or 5 ROIs, individual peaks, splitting peaks into lower and upper energy tails, subtraction K factors applied to both the alpha and beta counts.

This table covers only some of the algorithms that could be used.

EXAMPLE OF "ROI" METHOD OF ANALYSIS



EXAMPLE OF "PEAK SHAPE" FITTING



EXAMPLE OF "EXPONENTIAL FIT" OF THE LOW ENERGY TAIL